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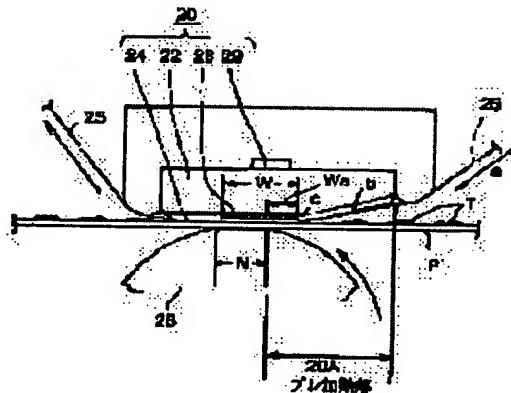
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(54) HEATING DEVICE AND IMAGE FORMING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent image scattering when a material to be heated is forced into a heating nip portion by passing the material to be heated through a preheating portion for preheating before it is forced into the heating nip portion.

SOLUTION: In a film heating type thermal image fixing device, a heater 20 has an inflection point (c) upstream of a fixing nip portion B, and the side of the heater 20 opposite to a storage medium P has a slope that gets farther from the fixing nip portion N as it goes upstream from the inflection point (c). A film 25 to be fixed makes sliding movement as it approaches or comes into contact with the slope. The outwardly projected portion 20A of the heater 20 serves as a preheating portion for the storage medium P. The jutting portion Wa of a heating element 23 imparts thermal energy to the storage medium P before the medium is forced into the fixing nip portion B, thereby heating the outwardly extended portion 20A of the heater which serves as the preheating portion. At the preheating portion the storage medium P is dried and its toner is increased in viscosity, so that even if heat is applied immediately before the fixing nip portion B, explosive formation of steam is avoided to prevent scattering of unfixed toner images.



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CLAIMS

[Claim(s)]

[Claim 1] Make a film insert between heating objects and pressurization members by which fixed support was carried out, and the heating nip section is made to form in it. It is the heating apparatus which introduces heated material between a film of this heating nip section, and a pressurization member, is made to carry out pinching conveyance of the heating nip section together with a film, and heat-treats heated material. A portion which a heating object is equipped with a heating element prolonged in the direction of a right angle in the conveyance direction of a film and heated material in the heating nip section, and this heating element has in a heating nip section field, It has a portion in a heating nip outside by the side of heated material carrying in of the heating nip section. As for a heating object, an opposed face with heated material has a folding point in a film and the heated material conveyance direction upstream rather than the heating nip section. a slant face which goes to a film and the heated material conveyance direction upstream from the folding point and where it is alike, and it follows and an opposed face with heated material of a heating object keeps away from a heating nip section horizontal line — **** — heating apparatus characterized by carrying out sliding migration while it gets down and a film approaches or contacts the slant face.

[Claim 2] It is calorific value of a portion which is in a heating nip outside of Q1 and this heating element about gross calorific value of a heating element Q2 Heating apparatus according to claim 1 characterized by making it set to $0.1 < Q2/Q1 < 0.4$ when it carries out.

[Claim 3] A heating object is heating apparatus according to claim 1 or 2 characterized by having exoergic distribution to which calorific value becomes large toward the downstream from a film and the heated material conveyance direction upstream.

[Claim 4] Heating apparatus of any one publication of claim 1 characterized by arranging a heating element including a folding point of a heating object thru/or claim 3.

[Claim 5] Heating apparatus of any one publication of claim 1 characterized by being the record medium which supported an image with which heated material should be established, and equipment being a heating anchorage device which makes this record medium carry out heat fixing of the image thru/or claim 4.

[Claim 6] Image formation equipment which has an image formation means to form a non-established image in a record medium, and a heating fixing means to make a record medium carry out heat fixing of the non-established image, and is characterized by this heating fixing means being the heating apparatus of any one publication of claim 1 thru/or claim 4.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention makes a film insert between the heating objects and the pressurization members by which fixed support was carried out, and makes the heating nip section form in it, and the heating apparatus and this heating apparatus of the film heating method which introduces heated material between the film of this heating nip section and a pressurization member, is made to carry out pinching conveyance of the heating nip section together with a film, and heat-treats in heated material are related in it to the image-formation equipment had as a heating anchorage device of an image.

[0002]

[Description of the Prior Art] The heating apparatus of the above film heating methods is indicated by JP,63-31318,A etc. In image formation equipments, such as – laser beam printer facsimile microfilm reader printer, image display (display) equipment, and a record machine, for example, a copying machine — With proper image formation process means, such as electrophotography, electrostatic recording, and magnetic recording The toner image which is not established corresponding to the image information of the purpose formed in the field of record media (an imprint material sheet electrofax sheet, an electrostatic recording sheet, printing paper, etc.) by the indirect (imprint) method or the direct method using the toner which consists of resin of heating melting nature etc. is used as a permanent fixing image. It is utilizable as an image anchorage device which carries out heating fixing processing.

[0003] In contrast with heat fixing type equipments, such as a hot calender roll method, a hot-platen method, a belt fixing method, a flash plate fixing method, an oven-fusing method, etc. with which the anchorage device of a film heating method is otherwise known **. Since power-saving and wait time shortening (quick-start nature) are attained since a low heat-capacity linear heating object can be used, and the point established [**.] and an isolation point can set up independently, Offset is also prevented, in addition it has an advantage with the various solvable defects of other method equipments, and is effective.

[0004] Configuration model drawing of the important section of this equipment was shown in drawing 8 . 20 makes a drawing carry out fixed support, and is arranged in it at the inferior-surface-of-tongue side of the heater base material 21 which makes it straight side perpendicularly and which it is oblong, is a heating object (it is hereafter described as a heater) of low heat capacity, and has rigidity and adiathermic ones. 25 is a heat-resistant film (it is hereafter described as a fixing film), 28 is an elastic pressure roll as a pressurization member, the fixing film 25 is made to insert between them, the pressure welding of the above-mentioned heater 20 and above-mentioned pressure roll 28 which carried out fixed support is carried out, and the heating nip section (it is hereafter described as the fixing nip section) N is made to have formed. Transit conveyance of the fixing film 25 is carried out at the rate of predetermined in the direction of a of **** in the fixing nip section N, carrying out adhesion sliding in the fixing nip section N by the non-illustrated driving means or the rotation drive of a pressure roll in the field of a heater 20.

[0005] In the condition that transit conveyance of the fixing film 25 was carried out at the rate

of predetermined, and the ** tone of the heater 20 was carried out to a predetermined temperature. The record medium P which supported the non-established toner image T as heated material between the fixing film 25 of the fixing nip section N and the pressure roll 28 makes an image side a fixing film side, and by conveyance installation being carried out. This record medium P sticks the fixing nip section N to the field of the fixing film 25, and pinching conveyance of the fixing nip section N is carried out together with the fixing film 25. The image support side of a record medium P is heated at a heater 20 through the fixing film 25 in a fixing nip section passage process, the non-established toner image T becomes soft and fuses, and heat fixing is made. From the 25th page of a fixing film, the record medium which passed the fixing nip section N carries out curvature separation one by one, and discharge conveyance is carried out.

[0006] Generally, what makes a basic construct the energization heating element 23 with which the heater 20 as a heating object was formed in the fixing film opposed face side of the heat-resistant heater substrate 22 and this substrate along with substrate straight side thin band-like one is used. The overcoat layer for heater surface protections which 24 made cover the heating element forming face side of the heater substrate 22, and 29 are the heater temperature detector elements arranged in the rear-face side of the heater substrate 22.

[0007] The temperature up of the heater 20 is carried out to a heating element 23 by pyrexia of this heating element by energization being made, feed of the heater temperature information is carried out to a non-illustrated energization control circuit from the temperature detector element 29, and the energization to a heating element 23 is controlled and **-tone-managed so that a heater 20 may be maintained by predetermined temperature.

[0008] The width of face W of a heating element 23 (size of a film and the record-medium conveyance direction) was almost equivalent to the width of face of the fixing nip section N, or was set as less than [it], is considering as the configuration which carries out the correspondence location of the heating element 23 into the fixing nip section N, and had become the configuration of concentrating and heating only the inside of the fixing nip section N as much as possible.

[0009] However, in order that it is rapidly heated by inrush and coincidence and the moisture into the fixing nip section N contained in the record medium serves as a steam, and the record medium P which supported the non-established toner image T may blow on a record-medium conveyance entrance side and may come out from the fixing nip section N if it rushes in if it is made such a configuration, the non-established toner image T on a record medium P flies, and is legible in the so-called "spilling" phenomenon powder carried out.

[0010] By then, the thing which you make the heating object 20 broad like drawing 9, and is made for a film and the record-medium conveyance direction upstream to possess way extension overhang section 20A outside the heating object 20 from the fixing nip section N. Making a record medium P pre heat by way extension overhang section 20A outside this heating object 20 before fixing nip section inrush, carrying out desiccation of this record medium and viscous raising of Toner T, and suppressing the above-mentioned spilling phenomenon in the fixing nip section N is known.

[0011]

[Problem(s) to be Solved by the Invention] However, the time of the conditions out of which spilling of images in case a record medium contains many moisture by the class and high-humidity environment of a record medium tends to come also in the equipment of the pre heating configuration of above-mentioned drawing 9. When the quick start tended to be carried out from the time of the anchorage device having got cold, in pre heating unit 20A in front of the fixing nip section, the condition that pre heating which makes enough desiccation of a record medium and viscous raising of Toner T was not made might also be produced, and spilling might occur.

[0012] Although this invention is similarly the heating apparatus of a pre heating method, if the condition that it is always fully unstable is made to secure and it is in an image heating anchorage device, without pre heating of the material in front of the heating nip section heated [introductory] being influenced by an operating environment, the service condition, etc., the

heating apparatus which enabled it to prevent generating of the above image spilling phenomena certainly, and the image-formation equipment equipped with this heating apparatus as heating anchorage devices are offered.

[0013]

[Means for Solving the Problem] This invention is heating apparatus and image formation equipment which are characterized by the following configuration.

[0014] (1) Make a film insert between heating objects and pressurization members by which fixed support was carried out, and make the heating nip section form in it. It is the heating apparatus which introduces heated material between a film of this heating nip section, and a pressurization member, is made to carry out pinching conveyance of the heating nip section together with a film, and heat-treats heated material. A portion which a heating object is equipped with a heating element prolonged in the direction of a right angle in the conveyance direction of a film and heated material in the heating nip section, and this heating element has in a heating nip section field, It has a portion in a heating nip outside by the side of heated material carrying in of the heating nip section. As for a heating object, an opposed face with heated material has a folding point in a film and the heated material conveyance direction upstream rather than the heating nip section. a slant face which goes to a film and the heated material conveyance direction upstream from the folding point and where it is alike, and it follows and an opposed face with heated material of a heating object keeps away from a heating nip section horizontal line — *** — heating apparatus characterized by carrying out sliding migration while it gets down and a film approaches or contacts the slant face.

[0015] (2) calorific value of a portion which is in a heating nip outside of Q1 and this heating element about gross calorific value of a heating element — Q2 ** — a time of carrying out — 0.1 — < — heating apparatus given in (1) characterized by making it set to $Q2/Q1 < 0.4$.

[0016] (3) A heating object is heating apparatus given in (1) characterized by having exoergic distribution to which calorific value becomes large toward the downstream from a film and the heated material conveyance direction upstream, or (2).

[0017] (4) Heating apparatus of any one publication of (1) characterized by arranging a heating element including a folding point of a heating object thru/or the (3).

[0018] (5) Heating apparatus of any one publication of (1) characterized by being the record medium which supported an image with which heated material should be established, and equipment being a heating anchorage device which makes this record medium carry out heat fixing of the image thru/or the (4).

[0019] (6) Image formation equipment which has an image formation means to form a non-established image in a record medium, and a heating fixing means to make a record medium carry out heat fixing of the non-established image, and is characterized by this heating fixing means being the heating apparatus of any one publication of (1) thru/or the (4).

[0020] Namely, heat generated from a heating element portion of a heating nip outside by considering as the above-mentioned configuration Because it not only warms heated material before rushing into the heating nip section, but a heating object has the slant face section (chamfer) in a film and the heated material conveyance direction upstream rather than the heating nip section Since heat mainly emitted from a heating element portion of a heating nip outside as the result by heat capacity becoming [volume for this heating soma as a pre heating unit] small small gets across to a part for this heating soma as a pre heating unit on an effect target more, Temperature for this heating soma tends to become high, heat can also be efficiently told to a film which approaches or contacts and slides on that, and the condition of fully being made is always secured to stability, without heated material pre heating before the heating nip section being influenced by an operating environment, service condition, etc.

[0021] Before heated material rushes into the heating nip section, it is pre heated in a process in which a part for a heating soma as the above-mentioned pre heating unit is passed. If it is in an image heating anchorage device, generating of image spilling by the heating nip section (fixing nip section) can be prevented by a record medium being dried by the pre heating, and viscous raising of a toner of a non-established toner image being made. Moreover, since it becomes hot gradually before a record medium results in the heating nip section in a part for a heating soma

as a pre heating unit which has the above-mentioned slant face section, an effect is not to generate a steam explosively at the time of heating nip section inrush, and prevent generating of spilling.

[0022]

[Embodiment of the Invention]

<Operation gestalt 1> (drawing 1 – drawing 3)

(1) The whole equipment block diagram 1 is an outline block diagram of the heating apparatus of this operation gestalt. The heating apparatus of this example is an image heating anchorage device of a film heating method. The same sign is given to the configuration member portion which is common to the equipment of above-mentioned drawing 8 or drawing 9, and explanation for the second time is omitted.

[0023] In drawing 1, 26 and 27 are the drive rolls and follower rolls which were arranged in the heater 20 as a heating object made to hold to a base material 21 [abbreviation]. The fixing film 25 as a heat-resistant film is used as the endless-belt-like film, and has carried out the *** set-up of this film 25 among the three above-mentioned members 26**27**20.

[0024] The rotation drive of the drive roll 26 is carried out by the driving source device M at the clockwise rotation of ***. The follower roll 27 makes it serve as the tension roll of the endless-belt-like fixing film 25, and the rotation drive of the fixing film 25 is carried out without Siwa, meandering, and speed delay with the same peripheral velocity as the bearer rate of the record medium P which supported the non-established toner image T currently conveyed by the clockwise rotation a from the predetermined peripheral-velocity, i.e., the non-illustrated image formation section, side with the rotation drive of a drive roll 26 on the upper surface.

[0025] The pressure roll 28 as a pressurization member is a roll which has the good rubber elastic layer of mold-releases characteristic, such as silicone rubber. Make the descending side film portion of the aforementioned endless-belt-like fixing film 25 pinch, carry out an opposite pressure welding with the contact pressure of 4-7kg of total pressure to the inferior surface of tongue of said heating object 20 with an energization means, and the fixing nip section N is made to have formed. Follower rotation is carried out at the counterclockwise rotation of the forward direction in the transit conveyance direction in the fixing nip section N of a film 25.

[0026] Since heating fixing of a toner image is repeatedly presented with the fixing film 25 of the shape of an endless belt by which a rotation drive is carried out, it is excellent in thermal resistance, a mold-release characteristic, and endurance, and, generally uses the thing of thin meat 40 micrometers or less preferably the total thickness of 100 micrometers or less.

[0027] for example, it is ***** etc. at 10-micrometer thickness about the mold-release characteristic coat layer of the monolayer film of heat-resistant resin, such as polyimide polyether imide and PES-PF (ethylene tetrafluoride-perfluoroalkylvinyl ether copolymer resin), or a compound layer film, for example, 20-micrometer thickness film, which added electric conduction material to fluororesins, such as PTFE (polytetrafluoroethylene resin) and PAF, at least at the image contact side side.

[0028] The following (2) terms explain the details configuration of the heater 20 as a heating object.

[0029] The heater base material 21 can consist of composite material of high heat resistant resin, such as PPS (polyphenylene sulfide), PAI (polyamidoimide), PI (polyimide), PEEK (polyether ether ketone), and a liquid crystal polymer, these resin, a ceramic metal, glass, etc., etc.

[0030] In the condition that **(ed), transit conveyance of the fixing film 25 was carried out at the rate of predetermined like the equipment of above-mentioned drawing 8 or drawing 9, and the ** tone of the heater 20 was carried out to a predetermined temperature, heat fixing of the non-established toner image T is carried out at a record medium P by conveyance installation of the record medium P as heated material being carried out between the fixing film 25 of the fixing nip section N, and a pressure roll 28.

[0031] (2) the block diagram 2 of a heater 20 showed expansion model drawing of a heater portion, and drawing 3 showed the heating element forming face side of a heater -- it is a notch perspective diagram a part.

[0032] The heater substrates 22 are the thickness of 1.0mm, width of face of 10mm, a right

conductor with a length of 40mm, for example, an alumina, aluminum nitride, etc., and, as for the film and the record-medium conveyance direction upstream (it is hereafter written as the conveyance direction upstream) by the side of the heating element forming face of this heater substrate 22 (substrate surface side), beveling with a thickness of 0.5mm is performed to width of face of 2mm. b is the chamfer.

[0033] A heating element 23 is an energization heating element of the linear or band-like low heat capacity which coating of the screen-stencil etc. was carried out [heat capacity] to width of face of W= 2.5mm, and made electric resistance materials, such as Ag/Pd, RuO₂, and Ta₂N, provide along with the longitudinal direction on the surface of a substrate.

[0034] 31-31 is the electrode for electric supply which was made to connect to the both ends of the above-mentioned heating element 23, and the both-ends side on the surface of a substrate was made to carry out formation possession, for example, by screen-stencil etc., carries out coating of Ag etc. and forms it.

[0035] The overcoat layer 24 for heater surface protections is a thin layer of heat-resisting glass.

[0036] In the condition of having made the fixing film 25 inserting an above-mentioned heater 20 and an above-mentioned pressure roll 28, and having made the fixing nip section N of predetermined width of face forming, the heating element 23 is made the related configuration from which the width-of-face section has protruded a part of conveyance direction upstream of the width-of-face section into the fixing nip outside by the side of record-medium carrying in of the fixing nip section N while carrying out the correspondence location at the fixing nip section N like drawing 2. Wa is the heating element flash section.

[0037] Moreover, said chamfer of the heater substrate 22 is *****ed and located in the fixing nip outside by the side of record-medium carrying in of the fixing nip section N, namely, a slant face where an opposed face with the record medium as heated material has a folding point c in the conveyance direction upstream, and, as for a heater 20, goes to the conveyance direction upstream from the folding point c from the fixing nip section N and where it is alike, and it follows and an opposed face with the record medium of a heater 20 keeps away from a fixing nip section horizontal line — **** — it gets down, and sliding migration is carried out while the fixing film 25 approaches or contacts the slant face. Method extension overhang section of outside of heater 20A containing the above-mentioned beveling slant face section of the conveyance direction upstream becomes the pre heating unit of a record medium P from the fixing nip section N.

[0038] It: **, and the aforementioned heating element flash section Wa heats method overhang section of outside of heater 20A containing the above-mentioned beveling slant face section as a pre heating unit of a record medium, while giving heat energy to the record medium P before fixing nip section inrush. In this case, since it gets across to method extension overhang section of outside of heater 20A effectively [this method extension overhang section of outside of heater 20A / heat capacity becomes small by beveling b carrying out the heater substrate 22, and / the generating heat in the heat to generate, especially the heating element flash section Wa of a heating element 23], the temperature of this method extension overhang section of outside of heater 20A becomes easy it becoming high. therefore, the condition of fully be make be always secure to stability, without also being able to tell heat effectively to the fixing film 25 which carry out sliding migration, and record medium pre heating before the fixing nip section be influence by an operating environment, the service condition, etc., approach or contact the slant face section of this method extension overhang section of outside of heater 20A.

[0039] Before the record medium introduced into the fixing nip section N rushes into the fixing nip section N Mind the fixing film 25, and approach or contact and method extension overhang section of outside of heater 20A containing the above-mentioned beveling slant face section as a pre heating unit is passed. Even if it is gradually warmed in the passage process, desiccation and viscous raising of a toner are made and directly powerful heat is finally applied from the heating element flash section Wa just before the fixing nip section, there is no generating of an explosive steam and generating of the spilling phenomenon of a non-established toner image can be prevented.

[0040] <an operation gestalt 2> — since there are too few the effects are before fixing nip section inrush and pre heat a record medium, in the equipment of the above-mentioned operation gestalt 1' when the heating element flash section Wa has too little this — sufficient effect profit — hard — it becomes, and when many [too], make a heater substrate 22 produce a crack and ***** is also. Since the direction of air has [this] bad thermal conductivity compared with a pressure roll 28, as for the portion Wa of the fixing nip outside of a heating element 23, temperature tends to become high. Therefore, if the amount of heating element flashes from the fixing nip section N is made [many] too much, since a temperature gradient will become large by fixing nip circles and the fixing nip outside, the strain of a substrate 22 by thermal expansion will increase, and it will break as the result.

[0041] Then, this operation gestalt was investigated about the rate into which a heating element 23 is made to protrude from the fixing nip section N.

[0042] As shown in drawing 2 and drawing 3, width of face of W and the heating element flash section is set to Wa for full [of a heating element 23]. Moreover, it is the calorific value of Q1 and a heating element flash portion about the gross calorific value of a heating element 23 Q2 It is Q1 by changing W for full [of a heating element 23], when it carries out. Q2 A ratio is changeable.

[0043] It is table 1, table 2 and a table 3Q1, and Q2. The spilling phenomenon at the time of making it change and the crack of a heater substrate are summarized.

[0044] Setting a table 1 to W= 2.5mm, the thing table 2 which beveled to the substrate 22 is set to W= 4.5mm, and the thing table 3 which beveled to the substrate 22 is set to W= 2.5mm, and does not bevel to a substrate 22.

[0045] When it bevels from a table 1 and a table 2 to a substrate 22, it is Q2 / Q1. It turns out that it will scatter if close is in 0.4 from 0.1, and a substrate crack does not happen. Moreover, it became almost the same [a result] as for a with a width-of-face sizes [other than two] (the 2.5 above-mentionedmm and 4.5mm) thing about W.

[0046] moreover, it bevels from a table 3 to a substrate 22 — ** — it scatters, and since there is no place where a substrate crack both does not occur, it turns out that a substrate 22 is beveled.

[0047] Therefore, a heating element 23 is made to protrude into the fixing nip outside of the conveyance direction upstream from the fixing nip section N. By the heater substrate portion made to jut out over the conveyance direction upstream beveling, and constituting from the fixing nip section N in the relation of $0.1 < Q2/Q1 < 0.4$ The record medium before fixing nip section inrush can be enough pre heated without the evil of the crack of a substrate 22, and spilling can be prevented.

[0048]

[A table 1]

表1

Q_2 / Q_1	飛び散り	基板割れ
0.05	×	○
0.1	○	○
0.2	○	○
0.3	○	○
0.4	○	○
0.5	○	△
0.6	○	×

[0049]

[A table 2]

表2

Q_2 / Q_1	飛び散り	基板割れ
0.05	△	○
0.1	○	○
0.2	○	○
0.3	○	○
0.4	○	○
0.5	○	×
0.6	○	×

[0050]

[A table 3]

表3

Q_2 / Q_1	飛び散り	基板割れ
0.05	×	○
0.1	×	○
0.2	△	○
0.3	△	○
0.4	△	○
0.5	○	△
0.6	○	×

[0051]

[External Character 1]

表中の記号の説明

	飛び散り	基板割れ
○	発生なし	割れない
△	発生するが実用上問題無し	割れることがある
×	発生する	割れる

<Operation gestalt 3> (drawing 4)

This operation gestalt forms the heating element 23 in two fields, 23A and 23B, in the cross direction like drawing 4. Field 23B is in the conveyance direction upstream to field 23A, and the calorific value per unit area is very small rather than field 23A.

[0052] In the case of this operation gestalt, field 23A is width-of-face WA = 0.4mm of whole heating element width of face containing field 23B of W= 2.0mm, and field 23A, and width-of-face WB = 1.6mm of field 23B, and, in the calorific value of field 23A, the calorific value of field 23B has become 20% of the heating element 23 whole 80% of the calorific value of the heating element 23 whole.

[0053] If it is made such a configuration, in order to fulfill the conditions of $0.1 < Q_2 / Q_1 < 0.4$ shown in the operation gestalt 2, the conveyance direction upstream edge of the fixing nip section N should just come between 0.8mm and 1.7mm (i.e., the inside of 0.9mm) about from the conveyance direction upstream of a heating element 23.

[0054] To it, if it is a heating element with a same width of face of 2mm when calorific value per unit area of a heating element is used as a common whole surface homogeneity heating element,

the conveyance direction upstream edge of the fixing nip section N will have to enter among 0.2mm to 0.8mm, i.e., 0.6mm, from the conveyance direction upstream of a heating element 23 about, and it will be set to two thirds of these operation gestalten.

[0055] although the width of face of the fixing nip section N tend to change with the thermal expansion, the eccentricity, etc. of a pressure roll 28, it can pre heat a record medium effectively [before result in the fixing nip section], and adjustment of the location of the fixing nip section N not only become easy, but it prevent spilling of a toner image by consider as a heating element configuration like this operation gestalt, reduce the danger that evils, such as a heater substrate crack, will happen.

[0056] <Operation gestalt 4> (drawing 5)

Like drawing 5, in the heating element, this operation gestalt includes the folding point c of chamfer b of the heater substrate 22, and is arranged. That is, the heating element 23 is arranged ranging over chamfer b of the heater substrate 22. Moreover, the folding point c of beveling is in agreement with the edge of the fixing nip section N of the conveyance direction upstream. A chamfer has the advantage in which the location of fixing nip **** does not change even if there are the thermal expansion and eccentricity of a pressure roll 28, when not only an effect but the folding point a and the location of fixing nip **** which were explained with the operation gestalt 1 are doubled.

[0057] Therefore, since the location of the nip edge of the conveyance direction upstream of the fixing nip section N cannot change easily according to this operation gestalt, Reducing the danger that the ratio of the calorific value in the fixing nip section N and the calorific value besides the fixing nip section N will stop being able to change easily, and evils, such as a heater substrate crack, will happen, a record medium can be pre heated effectively [before resulting in the fixing nip section N], and spilling of a toner image can be prevented.

[0058] <Operation gestalt 5> (drawing 6)

(a) –(b) – (c) of drawing 6 shows other examples of a configuration gestalt of the heating apparatus of a film heating method, respectively.

[0059] The thing of (a) carries out the **** set-up of the heat-resistant endless-belt-like film 25, and is made to carry out the rotation drive of this film 25 between the heater 20 as a heating object, and drive roll 26 member.

[0060] The thing of (b) makes the outside of the heater base material 21 of a cross-section abbreviation semicircle arc which made the heater 20 hold attach the heat-resistant cylinder-like film 25 outside an inferior surface of tongue loosely, makes this film 25 insert, and carries out the opposite pressure welding of the pressure roll 28 to a heater 20. A film 25 is rotated carrying out the rotation drive of the pressure roll 28, and making a heater 20 carry out adhesion sliding of the film inside by the frictional force of the film 25 in the fixing nip section N, and a pressure roll 28.

[0061] The thing of (c) lets this out, makes it go via a heater 20 from a shaft 32 using the owner edge film of the long picture made into the roll volume as a heat-resistant film 25, is rolled round, and it is constituted so that transit migration may be carried out at the rate of predetermined to a shaft 33.

[0062] Also in the heating apparatus of the film heating method of such a configuration gestalt, this invention is effectively applicable.

[0063] <Operation gestalt 6> (drawing 7)

Drawing 7 is the outline block diagram of the example of image formation equipment. The image formation equipment of this example is the copying machine or printer of imprint type electrophotography process use.

[0064] 41 is the electrophotography photo conductor of a rotating-drum mold, and a rotation drive is carried out with a predetermined process speed (peripheral velocity) at the clockwise rotation of an arrow head.

[0065] 42 is a contact electrification roll as a photo conductor electrification means, predetermined electrification bias is impressed and electrification processing of the 41st page of the rotation photo conductor is uniformly carried out to predetermined polarity and potential with this electrification roll 42.

- [0066] The exposure 43 of the target image information is made by the non-illustrated image information exposure means sections (the slit image formation exposure means of a manuscript image, laser beam scan exposure means, etc.) to the electrification processing side of this rotation photo conductor 41, and the electrostatic latent image corresponding to the target image information is formed in the 41st page of a rotation photo conductor.
- [0067] The latent image is developed as a toner image by toner development equipment 44.
- [0068] The toner image is imprinted from the non-illustrated feed section by the imprint section which was contacted to the rotation photo conductor 41 and this and which is the pressure-welding nip section with the transfer roller 45 with which predetermined imprint bias is impressed to the imprint material P as a record medium conveyed to predetermined timing.
- [0069] The imprint section is passed, the imprint of a toner image is separated from the 41st page of a rotation photo conductor, for example, conveyance installation is carried out, and the carrier beam imprint material P receives heating fixing processing of a non-established toner image in the heating apparatus 50 as an image heating anchorage device of above-mentioned drawing 1, and is outputted to it as a copy or a print.
- [0070] The 41st page of the rotation photo conductor after the toner image imprint to the imprint material P is cleaned by cleaning equipment 47 in response to removal of residual affixes, such as the imprint remaining toner, and imaging is repeatedly presented with it.
- [0071]

[Effect of the Invention] According to this invention, as mentioned above about the heating apparatus of a film heating method and a pre heating method The condition that it is always fully unstable, without pre heating of the material in front of the heating nip section heated [introductory] being influenced by an operating environment, the service condition, etc. is securable. If it is in an image heating anchorage device, generating of an image spilling phenomenon can be prevented certainly, and quality improvement of an output image can be attained in image formation equipment equipped with this image heating anchorage device and this image heating anchorage device.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The outline block diagram of the heating apparatus of the operation gestalt 1

[Drawing 2] Expansion model drawing of a heater (heating object) portion

[Drawing 3] the part which showed the heating element forming face side of a heater — a notch perspective diagram

[Drawing 4] the part which showed the heating element forming face side of the heater in the heating apparatus of the operation gestalt 3 — a notch perspective diagram

[Drawing 5] the part which showed the heating element forming face side of the heater in the heating apparatus of the operation gestalt 4 — a notch perspective diagram

[Drawing 6] (a) –(b) – (c) is drawing of the example of a configuration gestalt of everything but the heating apparatus of a film heating method respectively.

[Drawing 7] The schematic diagram of the example of image formation equipment

[Drawing 8] Configuration model drawing of the heater of conventional equipment (the 1)

[Drawing 9] Configuration model drawing of the heater of conventional equipment (the 2)

[Description of Notations]

20 Heating Object

22 Substrate

23 Heating Element

24 Surface-Protection Layer

25 Heat-resistant Film

26 Drive Roll

27 Follower Roll

28 Pressure Roll (Pressurization Member)

b Beveling slant face section

c Folding point

N Heating nip section

W Heating element width of face

Wa Heating element flash section

20A Pre heating unit

P Heated material (record medium)

[Translation done.]

* NOTICES *

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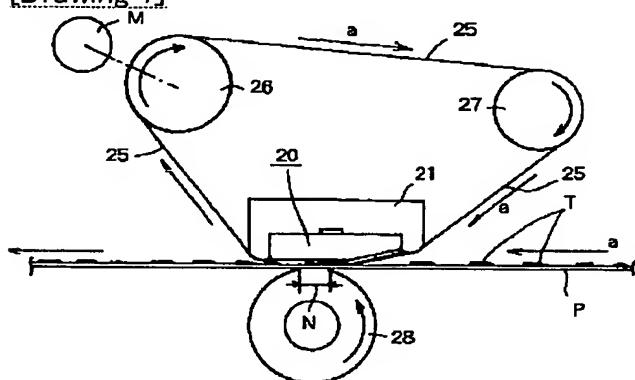
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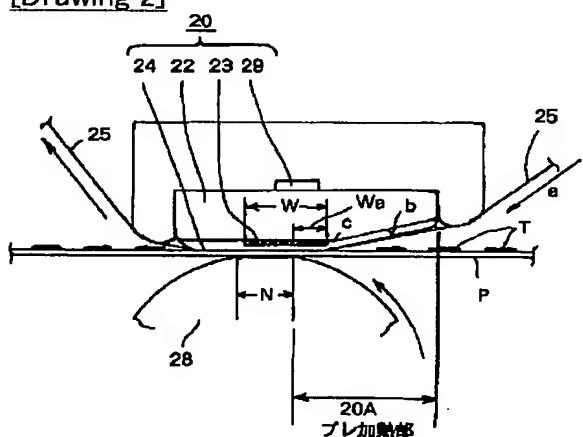
3. In the drawings, any words are not translated.

DRAWINGS

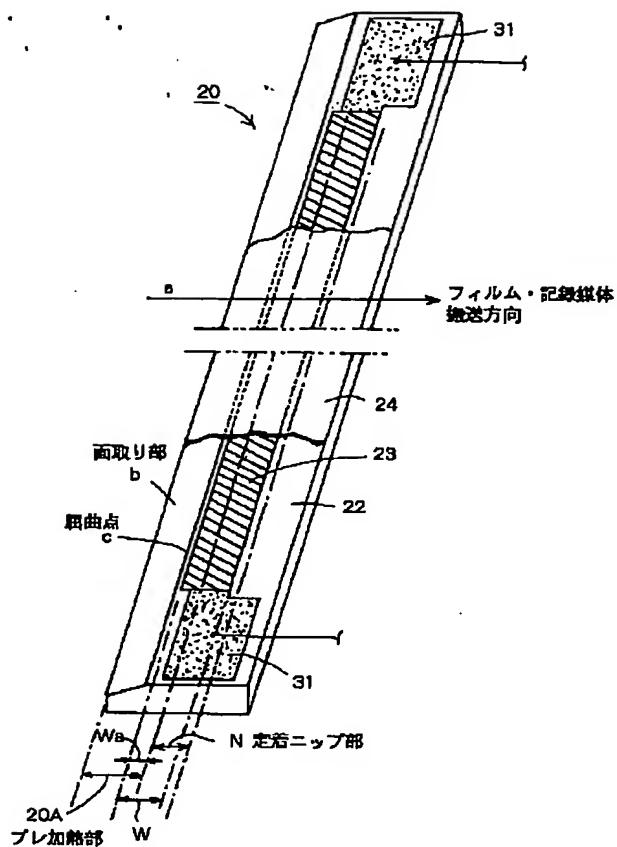
[Drawing 1]



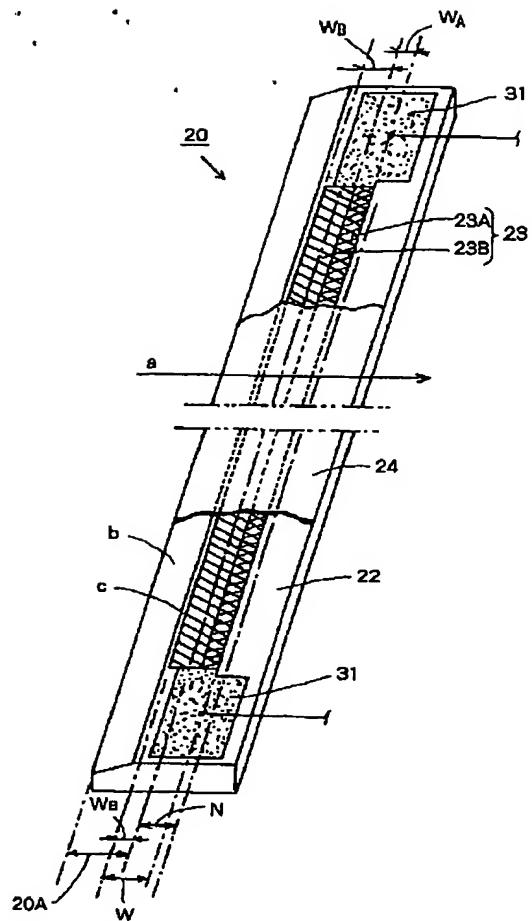
[Drawing 2]



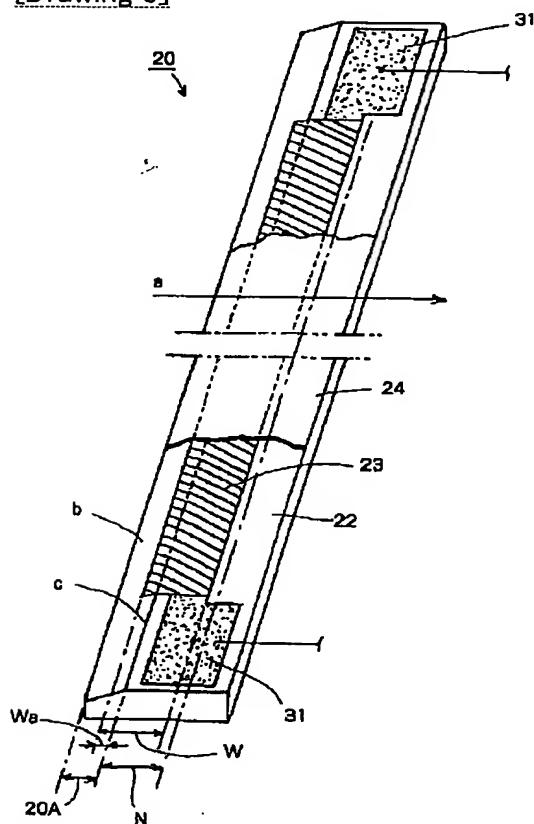
[Drawing 3]



[Drawing 4]

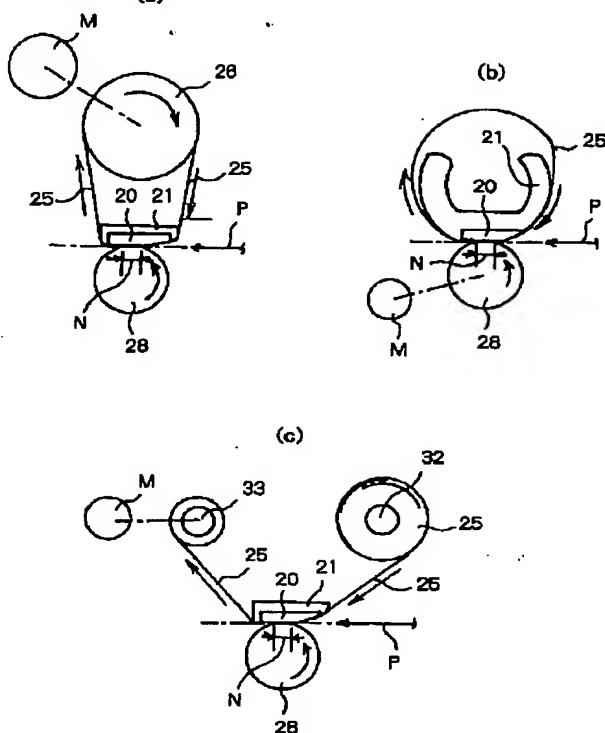


[Drawing 5]

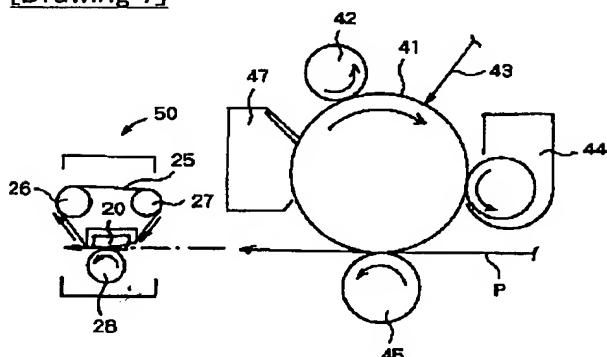


[Drawing 6]

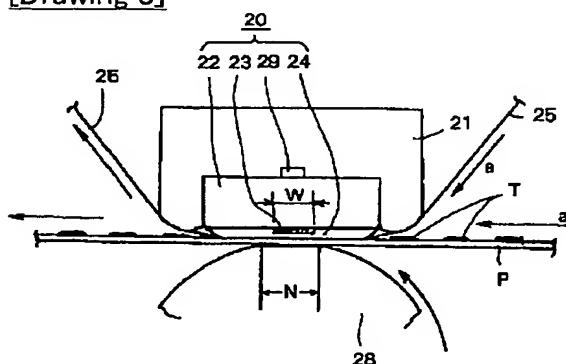
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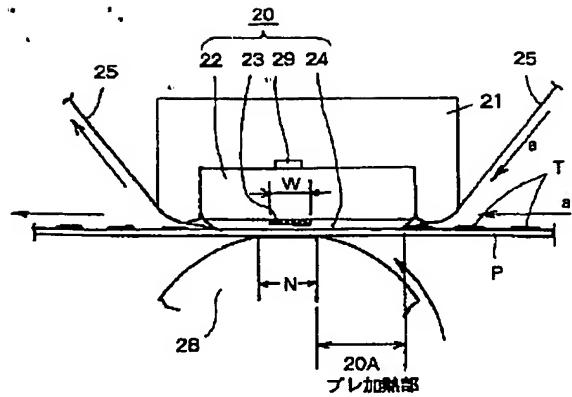
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]

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(54) [発明の名称] 加熱装置及び画像形成装置

(21) 電気記号	F.1	電気記号	内燃装置	(1) 特許出願公開番号
H 05 B	3/00	3 3 0	H 05 B 3/00	3 3 0 2
G 03 G	15/20	1 0 1	G 03 G 15/20	1 0 1

(57) [要約]

【課題】 フィルム加熱方式、フレイク方式の加熱装置

について、加熱ニップ部前の導入段加熱材のブレ加熱が使用環境・使用条件等に左右されることなく常に安定に十分になされる状態を確保して、画像加熱装置においては画像飛び散り現象の発生を防止すること。

【解決手段】 加熱体20は加熱ニップ部Nにおける被加熱材搬送方向に直角方向に並びる導熱部Waをもち、被加熱材搬送方向上流側において屈曲点cをもち、該屈曲点から被加熱材搬送方向上流側に行くにつれては加熱材とその対向面が加熱ニップ部Wb水平線から遠ざかるような斜面をもち、

加熱材は被加熱材との対向面が加熱ニップ部よりもフィルム・被加熱材搬送方向上流側において屈曲点をもち、その屈曲点からフィルム・被加熱材搬送方向上流側に行きにしたがって加熱体の導入段加熱材との対向面が加熱ニップ部水平線から遠ざかるよう斜面をもっており、フィルムがその斜面に近接もしくは接触しながら滑動移動することを特徴とする加熱装置。

【請求項1】 加熱体の導入段加熱部をQ1、斜発熱部の加熱ニップ部外にある部分の導入段加熱部をQ2としたとき、
 $0.1 < Q_2 / Q_1 < 0.4$

となるようにしたことを特徴とする請求項1に記載する加熱装置。

【請求項3】 加熱体はフィルム・被加熱材搬送方向上流側から下流側にむかって熱伝導が大きくなる熱流分布を有することを特徴とする請求項1または請求項2に記載の加熱装置。

【請求項4】 热伝導が加熱体の屈曲点を含んで配線されることを特徴とする請求項1乃至請求項3のいずれか一つに記載の加熱装置。

【請求項5】 増加熱材が定着すべき画像を相持した配線装置であり、装置が記録媒体に画像を記録させる加熱装置であることを特徴とする請求項1乃至請求項4のいずれか一つに記載の加熱装置。

【請求項6】 記録媒体に未定着画像を形成する画像形成装置、成写装置、その未定着画像を記録媒体に熱定着させる加熱装置を有し、該加熱装置が定着手段が斜面Q1乃至請求項4のいずれか一つに記載の加熱装置であることを特徴とする画像形成装置。

【発明の詳細な説明】

【発明の属する技術分野】 本発明は、固定支持された加熱材と加熱部材との間にフィルムを挟ませて加熱ニップ部を形成させ、被加熱ニップ部のフィルムと加熱部材との間に被加熱材を導入してフィルムと一緒に加熱ニップ部を被持特許搬送させて被加熱材を加熱するフィルム加熱方式の加熱装置

としてして構成した画像形成装置に関する。

【0002】

【従来の技術】 上記のようないくつかの加熱装置は特開昭63-31318号公報等に開示されてお

【特許請求の範囲】

【請求項1】 固定支持された加熱部材と加圧部材との間にフィルムを挟ませて加熱ニップ部を形成させ、被加熱材ニップ部のフィルムと加圧部材との間に被加熱材を導入してフィルムと一緒に加熱處理する加熱装置であり、電子写真・電気記録・磁気記録等の適宜の画像装置

がプロセス手段により加熱溶融性の前段よりなるトナーを用いて記録媒体(紙シート・印刷紙など)の面に間接(転写)方式もしくは直接方式で形成した目的の画像情報をに対応した未定着のトナー画像を水久固定画像として報に対応する画像定着装置として活用できる。

【請求項2】 フィルム加熱方式の定着装置は、他にかられる熱ロール方式・熱板方式・ベルト定着方式・

クシュー定着方式・オーブン定着方式等の熱定着装置との対比において、①、低粘度熱融状態物体を用いることができるため、省電力化・ウェイトダイム短縮化(ワックススタート性)が可能になり、②、定着点と分離点が別に設定できるため、ガス漏れも防止される、その他の方式装置との点々の欠点を解決できるなどの利点を有し、効果的なものである。

【請求項3】 フィルム8に機械装置の要部の構成概要を示す。20は図面上に垂直方向を長手とする横長で低粘度且の加熱体(以下、ヒーターと記す)であり、剛性・断熱性を有するヒーター支持体21の下面側に固定支承させて配設してある。25は耐熱性フィルム(以下、定着フィルムと記す)、28は加圧部材としての強性加压ローラーであり、上記の固定支持されたヒーター20と加压ローラー28とをその間に定着フィルム25を挟ませて圧接させて加熱ニップ部(以下、定着ニップ部と記す)Nを形成させてある。定着フィルム25は不図示の駆動手段もしくは加压ローラの回転運動により、定着ニップ部Nにおいてヒーター20が所定の速度で走行傳送される。

【請求項4】 定着フィルム25が所定の速度で走行傳送されるようにしたことを特徴とする請求項1乃至請求項4のいずれか一つに記載の加熱装置。

【請求項5】 増加熱材が定着すべき画像を相持した配線装置であり、装置が記録媒体に画像を記録させる加熱装置であることを特徴とする請求項1乃至請求項4のいずれか一つに記載の加熱装置。

【請求項6】 記録媒体に未定着画像を形成する画像形成装置、成写装置、その未定着画像を記録媒体に熱定着させる加熱装置を有し、該加熱装置が定着手段が斜面Q1乃至請求項4のいずれか一つに記載の加熱装置であることを特徴とする画像形成装置。

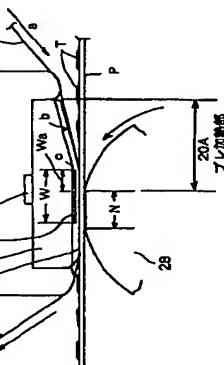
【発明の詳細な説明】

【0001】 フィルム加熱方式、フレイク方式の加熱装置について、加熱ニップ部前の導入段加熱材のブレ加熱が使用環境・使用条件等に左右されることなく常に安定に十分になされる状態を確保して、画像加熱装置においては画像飛び散り現象の発生を防止すること。

【解決手段】 加熱体20は加熱ニップ部Nにおける被加熱材搬送方向に直角方向に並びる導熱部Waをもち、被加熱材搬送方向内にある部分Waを構成する導熱部Wbよりも、被加熱材搬送方向上流側において屈曲点cをもち、該屈曲点から被加熱材搬送方向上流側に行くにつれては加熱材とその対向面が加熱ニップ部Wb水平線から遠ざかるような斜面をもち、

加熱材は被加熱材との対向面が加熱ニップ部よりもフィルムと一緒に加熱する。20は加熱ニップ部Nの画面側面部が定着フィルム25と接する。25を介してヒーター基板2と、該基板の定着フィルム対面側に沿って細帯状に形成された通電熱線

体23を基本構成体とするものが用いられている。24はヒーター基板2の端部が熱定着部形成面と接触させてお



曲率半径して排出搬送される。

【0006】 一般に、加熱体としてのヒーター20は、耐熱性のヒーター基板2と、該基板の定着フィルム対面側に沿って細帯状に形成された通電熱線

体23を基本構成体とするものが用いられている。24はヒーター基板2の端部が熱定着部形成面と接触させてお

る。

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により Q_1 と Q_2 の比を変えることができる。

[0043] 管1・管2・管3は Q_1 ・ Q_2 を変化させたときの飛び散り現象とヒーター基板の剥離についてまとめたものである。

[0044] 管1は、W=2・5 mmとし、基板2.2に面取りをしたものの料面に5が近接して接触しながら溶融移動する。定着ニップ部Pよりはみ出し部Wよりはみ出し部W'aと、基板2.2に面取りをしたものの面取り部Pのプレ加熱部となる。

[0038] 而して、前記の発熱体はみ出し部W'aが、定着ニップ部突入前の発熱体Pに熱エネルギーを与えるとともに、発熱体のプレ加熱部としての上記面取り斜面部を含むヒーター外方張り出し部2.0Aを加熱する。

この場合のヒーター外方張り出し部2.0Aはヒーター基板2.2が面取り部2.0Aを含むことにより熱容量が小さくなり、発熱体2.3の発生する熱、特に発熱体はみ出し部W'aでの発生熱が効果的にヒーター外方張り出し部2.0Aに伝わるために管ヒーター外方張り出し部2.0Aの温度が高くなりやすくなる。そのため、このヒーター外方張り出し部2.0Aの斜面部に近接しても接触しながら溶融移動する定着フィルム2.5にも熱を効果的に伝えることができ、定着ニップ部前の発熱体プレ加熱が使用環境・使用条件等に左右されることなく常に安定に十分になされる状態が確保される。

[0039] 定着ニップ部Nに導入される発熱体は、定着ニップ部Nへ突入する前に、プレ加熱部としての、上記面取り斜面部を含むヒーター外方張り出し部2.0Aを介して接触して通していく。その通過過程において徐々にあたまられて乾燥及びトナーの粘性が高くなされていき、最後に定着ニップ部直前で、発熱体はみ出し部W'aから直接強い熱が加えられても、爆発的な水蒸気の発生がなく、未定着トナー画像の飛び散り現象の発生が防止できる。

[0040] (実施形態2) 上記の実施形態1の装置において、発熱体はみ出し部W'aはこれが少しだけ定着ニップ部突入部で発熱体をプレ加熱する効果が少しだけ弱いため十分な物質供給にくくなるし、また多すぎるとヒーター基板2.2に割れを生じさせ忘れもある。これに加圧ローラ2.8に比べて空気の方が熱伝導性が悪いため、発熱体2.3の定着ニップ部Nからの発熱量は温度が高くなりやすい。従って、定着ニップ部Nから発熱体はみ出し量を多くしきると、定着ニップ部内部で定着ニップ部外で温度差が大きくなるため、基板2.2は熱膨張によるひずみが多くなり、その結果として割れてしまう。

[0041] そこで本実施形態は、発熱体2.3を定着ニップ部Nからはみ出させると別個について調べてみた。

[0042] 図2・図3に示すように、発熱体2.3の全幅をW、発熱体はみ出し部の幅をW'aとする。また発熱体2.3の総発熱量を Q_1 、発熱体はみ出し部分の発熱量を Q_2 としとき、発熱体2.3の全幅をWを変えること

により Q_1 と Q_2 の比を変えることができる。

[0043] 管1・管2・管3は Q_1 ・ Q_2 を変化させたときの飛び散り現象とヒーター基板の剥離についてまとめたものである。

[0044] 管1は、W=2・5 mmとし、基板2.2に面取りをしたものの料面に5が近接して接触しながら溶融移動する。定着ニップ部Pよりはみ出し部Wよりはみ出し部W'aよりも飛ばされ方向上流側の、上記面取り部の、上記面取り部2.0Aが定着発熱体Pのプレ加熱部となる。

[0038] 而して、前記の発熱体はみ出し部W'aが、定着ニップ部突入前の発熱体Pに熱エネルギーを与えるとともに、発熱体のプレ加熱部としての上記面取り斜面部を含むヒーター外方張り出し部2.0Aを加熱する。

この場合のヒーター外方張り出し部2.0Aはヒーター基板2.2が面取り部2.0Aを含むことにより熱容量が小さくなり、発熱体2.3の発生する熱、特に発熱体はみ出し部W'aでの発生熱が効果的にヒーター外方張り出し部2.0Aに伝わるために管ヒーター外方張り出し部2.0Aの斜面部に近接しても接触しながら溶融移動する定着フィルム2.5にも熱を効果的に伝えることができ、定着ニップ部前の発熱体プレ加熱が使用環境・使用条件等に左右されることなく常に安定に十分になされる状態が確保される。

[0039] 定着ニップ部Nに導入される発熱体は、定着ニップ部Nへ突入する前に、プレ加熱部としての、上記面取り斜面部を含むヒーター外方張り出し部2.0Aを介して接触して通していく。その通過過程において徐々にあたまられて乾燥及びトナーの粘性が高くなされていき、最後に定着ニップ部直前で、発熱体はみ出し部W'aから直接強い熱が加えられても、爆発的な水蒸気の発生がなく、未定着トナー画像の飛び散り現象の発生が防止できる。

[0040] (実施形態2) 上記の実施形態1の装置において、発熱体はみ出し部W'aはこれが少しだけ定着ニップ部突入部で発熱体をプレ加熱する効果が少しだけ弱いため十分な物質供給にくくなるし、また多すぎるとヒーター基板2.2に割れを生じさせ忘れもある。これに加圧ローラ2.8に比べて空気の方が熱伝導性が悪いため、発熱体2.3の定着ニップ部Nからの発熱量は温度が高くなりやすい。従って、定着ニップ部Nから発熱体はみ出し量を多くしきると、定着ニップ部内部で定着ニップ部外で温度差が大きくなるため、基板2.2は熱膨張によるひずみが多くなり、その結果として割れてしまう。

[0041] そこで本実施形態は、発熱体2.3を定着ニップ部Nからはみ出させると別個について調べてみた。

[0042] 図2・図3に示すように、発熱体2.3の全幅をW、発熱体はみ出し部の幅をW'aとする。また発熱体2.3の総発熱量を Q_1 、発熱体はみ出し部分の発熱量を Q_2 としとき、発熱体2.3の全幅をWを変えること

表2

Q_2 / Q_1	飛び散り	基板剥離
0.05	△	○
0.1	○	○
0.2	○	○
0.3	○	○
0.4	○	○
0.5	○	×
0.6	○	×

表3

Q_2 / Q_1	飛び散り	基板剥離
0.05	×	○
0.1	×	○
0.2	△	○
0.3	△	○
0.4	△	○
0.5	○	△
0.6	○	△
0.8	○	×

[0050] * [0051]

[表3] *

表中の配号の説明

飛び散り	基板剥離
○	発生なし
△	発生するが実用上問題無し
×	発生する

(実施形態3) (図4)

本実施形態は図4のように、発熱体2.3をその端方向に面取り部2.3Aと2.3Bの2つの腰部で形成している。傾城2.3Bは傾城2.3Aに対して搬送方向上流側にあり、傾城2.3Aよりも単位面積当たりの発熱量が非常に小さくなっている。

[0047] したがって、発熱体2.3を定着ニップ部Nから搬送方向上流側の定着ニップ部外にはみ出させ、定着ニップ部Nよりも搬送方向上流側に張り出させたヒータ基板部分は面取りし、 $0 < Q_2 / Q_1 < 4$ の範囲で定着ニップ部2.3Aと2.3Bの2つの腰部で形成している。傾城2.3Bは傾城2.3Aに対して搬送方向上流側にあり、傾城2.3Aよりも単位面積当たりの発熱量が非常に小さくなっている。

[0048] したがって、面取り部の屈曲部N端は実施形態1で説明した効果だけでなく、屈曲点Nと定着ニップ部端を合わせた場合、加圧ローラ2.8の熱膨張や屈曲部N端を含むヒーター部端部の位置がわからず、定着ニップ部N端は加熱して搬送方向上流側に張り出している。また面取り部の屈曲部N端は実施形態1で説明した効果だけではなく、屈曲点Nと定着ニップ部端を合わせた場合、加圧ローラ2.8の熱膨張や屈曲部N端を含むヒーター部端部の位置がわからず、定着ニップ部N端は加熱して搬送方向上流側に張り出している。

[0049] 本実施形態の場合、傾城2.3Aは傾城2.3Bを含む発熱体全幅W=2・0 mm、傾城2.3Aの傾城W_A=0・4 mm、傾城2.3Bの傾城W_B=1・6 mmで、30°あり、傾城2.3Aの発熱量は発熱体2.3全体の発熱量の80%、傾城2.3Bの発熱量は発熱体2.3全体の20%となっている。

[0050] 本実施形態の場合、傾城2.3Aは傾城2.3Bを含む発熱体全幅W=2・0 mm、傾城2.3Aの傾城W_A=0・4 mm、傾城2.3Bの傾城W_B=1・6 mmで、30°あり、傾城2.3Aの発熱量は発熱体2.3全体の80%、傾城2.3Bの発熱量は発熱体2.3全体の20%となっている。

により、一般的な全幅W=2・0 mm、すなわち定着ニップ部Nの搬送方向上流端から0・2 mmから0・8 mm、すなわち0・6 mmの間に定着ニップ部Nの搬送方向上流端が入らなければならず本実施形態の2/3となってしまう。

[0051] 定着ニップ部Nの搬送方向上流端がこれより前にある前に効率的に発熱するが、それに対し、発熱体はみ出し部Nの搬送方向上流端がこれより前にあるが、本実施形態の発熱体はみ出し部Nからはみ出させると別個について調べてみた。

[0052] (a) (b) (c) はそれぞれフィルムが熱運動させようとしたものである。

[0053] (a) のものは、加熱体としてのヒーター

2.0と駆動ローラ2.6部材間にエンドレスベルト状の耐熱性フィルム2.5を熱回転致してトナー画像の飛び散りを防ぐことができる。

[0054] したがって本実施形態は、面取り部N端は実施形態1で説明した効果だけではなく、屈曲点Nと定着ニップ部端を合わせた場合、加圧ローラ2.8の熱膨張や屈曲部N端を含むヒーター部端部の位置がわからず、定着ニップ部N端は加熱して搬送方向上流側に張り出している。

[0055] (a) (b) (c) はそれぞれフィルムが熱運動させようとしたものである。

[0056] (a) のものは、下面にヒーター2.0を保

持させた、根断面幅半円弧状のヒーター基板2.1の外側に円筒状の耐熱性フィルム2.5を熱回転致してトナー面

定着ニップ部に至る前にアーム的にプレ加熱してトナー面

飛び散りを防ぐことができる。

[0057] (a) (b) (c) はそれぞれフィルムが熱運動させようとしたものである。

[0058] (a) のものは、下面にヒーター2.0を保

持させた、根断面幅半円弧状のヒーター基板2.1の外側に円筒状の耐熱性フィルム2.5を熱回転致してトナー面

定着ニップ部に至る前にアーム的にプレ加熱してトナー面

飛び散りを防ぐことができる。

[0059] (a) のものは、下面にヒーター2.0を保

持させた、根断面幅半円弧状のヒーター基板2.1の外側に円筒状の耐熱性フィルム2.5を熱回転致してトナー面

定着ニップ部に至る前にアーム的にプレ加熱してトナー面

飛び散りを防ぐことができる。

表4

Q_2 / Q_1	飛び散り	基板剥離
0.05	×	○
0.1	○	○
0.2	○	○
0.3	○	○
0.4	○	○
0.5	○	△
0.6	○	×

表5

Q_2 / Q_1	飛び散り	基板剥離
0.05	×	○
0.1	○	○
0.2	△	○
0.3	△	○
0.4	△	○
0.5	○	△
0.6	○	×

表6

Q_2 / Q_1	飛び散り	基板剥離
0.05	×	○
0.1	○	○
0.2	△	○
0.3	△	○
0.4	△	○
0.5	○	△
0.6	○	×

表7

Q_2 / Q_1	飛び散り	基板剥離
0.05	×	○
0.1	○	○
0.2	△	○
0.3	△	○
0.4	△	○
0.5	○	△
0.6	○	×

